[Title of the Document] CLAIMS

[Claim 1]

A control system for controlling an output of a controlled object by a control input to the controlled object, comprising:

control value-calculating means for calculating a control value for control of the output of the controlled object with a predetermined control algorithm; and

control input-calculating means for calculating a modulation value by modulating the calculated control value, with a predetermined modulation algorithm based on a $\Delta\Sigma$ modulation algorithm, and calculating the control input to the controlled object based on the calculated modulation value,

wherein said control input-calculating means includes difference calculation for calculating a difference between the control value and the modulation value, in the predetermined modulation algorithm, and calculates the modulation value such that an absolute value thereof becomes equal to a predetermined value larger than a value of 1.

[Claim 2]

A control system for controlling an output of a controlled object by a control input to the controlled object, comprising:

control value-calculating means for calculating a control value for control of the output of the controlled object with a predetermined control algorithm; and

control input-calculating means for calculating a modulation value by modulating the calculated control value with a predetermined modulation algorithm based

on a $\Sigma\Delta$ modulation algorithm, and calculating the control input to the controlled object based on the calculated modulation value,

wherein said control input-calculating means includes first integral calculation for calculating an integral value of the modulation value, second integral calculation for calculating an integral value of the control value, and difference calculation for calculating a difference between the integral value of the control value and the integral value of the modulation value, in the predetermined modulation algorithm, and calculates the modulation value such that an absolute value thereof becomes equal to a predetermined value larger than a value of 1.

[Claim 3]

A control system for controlling an output of a controlled object by a control input to the controlled object, comprising:

control value-calculating means for calculating a control value for control of the output of the controlled object with a predetermined control algorithm; and

control input-calculating means for calculating a modulation value by modulating the calculated control value with a predetermined modulation algorithm based on a Δ modulation algorithm, and calculating the control input to the controlled object based on the calculated modulation value,

wherein said control input-calculating means includes integral calculation for calculating an integral value of the modulation value and difference calculation for calculating a difference between the control value and the integral value of the modulation

value, in the predetermined modulation algorithm, and calculates the modulation value such that an absolute value thereof becomes equal to a predetermined value larger than a value of 1.

[Claim 4]

A control system as claimed in any one of claims 1 to 3, wherein the predetermined value is set to a value an absolute value of which is larger than an absolute value of the control value.

[Claim 5]

A control system for controlling a cam phase of at least one of an intake cam and an exhaust cam for opening and closing an intake valve and an exhaust valve of an internal combustion engine, respectively, with respect to a crankshaft, comprising:

an electromagnetic variable cam phase mechanism that includes an electromagnet and changes the cam phase by an electromagnetic force of said electromagnet;

control value-calculating means for calculating a control value for control of the cam phase with a predetermined control algorithm; and

control input-calculating means for calculating a modulation value by modulating the calculated control value with a predetermined modulation algorithm based on a $\Delta\Sigma$ modulation algorithm, and calculating a control input to said electromagnetic variable cam phase mechanism based on the calculated modulation value,

wherein said control input-calculating means includes difference calculation for calculating a difference between the control value and the modulation value, in the predetermined modulation algorithm, and

calculates the modulation value such that an absolute value thereof becomes equal to a predetermined value larger than a value of 1.

[Claim 6]

A control system for controlling a cam phase of at least one of an intake cam and an exhaust cam for opening and closing an intake valve and an exhaust valve of an internal combustion engine, respectively, with respect to a crankshaft, comprising:

an electromagnetic variable cam phase mechanism that includes an electromagnet and changes the cam phase by an electromagnetic force of said electromagnet;

control value-calculating means for calculating a control value for control of the cam phase with a predetermined control algorithm; and

control input-calculating means for calculating a modulation value by modulating the calculated control value with a predetermined modulation algorithm based on a $\Delta\Sigma$ modulation algorithm, and calculating a control input to said electromagnetic variable cam phase mechanism based on the calculated modulation value,

wherein said control input-calculating means includes first integral calculation for calculating an integral value of the modulation value, second integral calculation for calculating an integral value of the control value, and difference calculation for calculating a difference between the integral value of the control value and the integral value of the modulation value, in the predetermined modulation algorithm, and calculates the modulation value such that an absolute value thereof becomes equal to a

predetermined value larger than a value of 1.

[Claim 7]

A control system for controlling a cam phase of at least one of an intake cam and an exhaust cam for opening and closing an intake valve and an exhaust valve of an internal combustion engine, respectively, with respect to a crankshaft, comprising:

an electromagnetic variable cam phase mechanism that includes an electromagnet and changes the cam phase by an electromagnetic force of said electromagnet;

control value-calculating means for calculating a control value for control of the cam phase with a predetermined control algorithm; and

control input-calculating means for calculating a modulation value by modulating the calculated control value with a predetermined modulation algorithm based on a Δ modulation algorithm, and calculating a control input to said electromagnetic variable cam phase mechanism based on the calculated modulation value,

wherein said control input-calculating means includes integral calculation for calculating an integral value of the modulation value and difference calculation for calculating a difference between the control value and the integral value of the modulation value, in the predetermined modulation algorithm, and calculates the modulation value such that an absolute value thereof becomes equal to a predetermined value larger than a value of 1.

[Claim 8]

A control system as claimed in any one of claims 5 to 7, wherein the predetermined value is set to a value an absolute value of which is larger than an

absolute value of the control value.

[Claim 9]

A control system for controlling an output of a controlled object to a target value by a control input to the controlled object, comprising:

output-detecting means for detecting the output of the controlled object;

target value-setting means for setting the target value;

control value-calculating means for calculating a control value for controlling the detected output of the controlled object to the set target value, with a predetermined control algorithm;

difference-calculating means for calculating a difference between the calculated control value and a first predetermined value; and

control input-calculating means for calculating a modulation value by modulating the calculated difference with an algorithm based on one of a Δ modulation algorithm, a $\Delta\Sigma$ modulation algorithm, and a $\Sigma\Delta$ modulation algorithm, and calculating the control input to the controlled object based on the calculated modulation value.

[Claim 10]

A control system as claimed in claim 9, wherein said control input-calculating means calculates the control input to the controlled object as a sum of the modulation value and a second predetermined value.

[Claim 11]

A control system for controlling a cam phase of at least one of an intake cam and an exhaust cam for opening and closing an intake valve and an exhaust valve of an internal combustion engine, respectively,

with respect to a crankshaft, to a target cam phase, comprising:

an electromagnetic variable cam phase mechanism that includes an electromagnet and changes the cam phase within a predetermined range by an electromagnetic force of said electromagnet, while holding the cam phase at one of limit values defining the predetermined range when the electromagnetic force is not acting;

cam phase-detecting means for detecting the cam phase;

target cam phase-setting means for setting the target cam phase;

control value-calculating means for calculating a control value for controlling the detected cam phase to the set target cam phase, with a predetermined control algorithm;

difference-calculating means for calculating a difference between the calculated control value and a first predetermined value; and

control input-calculating means for calculating a modulation value by modulating the calculated difference with an algorithm based on one of a Δ modulation algorithm, a $\Delta\Sigma$ modulation algorithm, and a $\Sigma\Delta$ modulation algorithm, and calculating a control input to said electromagnetic variable cam phase mechanism based on the calculated modulation value.

[Claim 12]

A control system as claimed in claim 11, wherein said control input-calculating means calculates the control input to said electromagnetic variable cam phase mechanism as a sum of the modulation value and a second predetermined value.